

FM linear series



Ultra-high-speed,
High-precision
Vertical Machining
Center Equipped
with Linear Motors

FM linear series

FM 200/5AXlinear
FM 350/5AXlinear
FM 400 linear



red
dot

W

Basic Information

Basic Structure

Travel Axis

Detailed

Information

Options

Capacity Diagram

Specifications

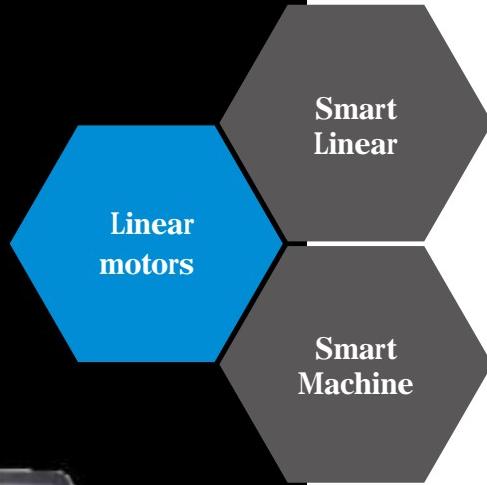
Customer Support

Service



FM linear series

The FM Linear Series offers super-fast traveling and great reliability with its high-speed spindle and linear axes driven by linear motors, in addition to excellent stability in cutting operation due to the adoption of anti-vibration materials.



Contents

- 02 Product Overview**
 - Basic Information**
 - 04 Basic Structure**
 - 04 Travel Axis**
- Detailed Information**
 - 06 Standard / Optional Specifications**
 - 09 Capacity Diagram**
 - 12 Machine / NC Unit Specifications**
- 14 Customer Support Service**

Sample work



Stable bed and structure design Stable cutting based on anti-vibration materials and symmetrical gantry structure.

Stable cutting based on anti-vibration materials and symmetrical gantry structure.

Outstanding productivity and cutting accuracy are delivered with 40,000 rpm spindles, linear motors, and direct-drive motors.

Heidenhain controller for maximum reliability

The adoption of Heidenhain controllers optimized for high-speed processing enhances machine reliability, visibility, and display applicability.

Basic Information

Basic Structure
Travel Axis

Detailed Information
Options
Capacity Diagram
Specifications

Customer Support
Service



Basic Structure

Stable cutting based on symmetrical gantry structure and anti-vibration materials (mineral casting).

Structural and Material Features

Gantry structure
Horizontally-symmetrical structure suitable for high-speed, high-precision machining
Guaranteed structural stability

Built with a mineral cast bed for stable performance

Built with a mineral cast bed for stable performance

Temperature ↑
Time →

Mineral cast materials
Ambient temperature
Casting

Normal cast materials
Mineral cast materials

↑ 25 times
Thermal stability 25 times greater



Axis System

The linear axes and rotary axes deliver high speed and superior accuracy.

Linear Axes Equipped with Linear Motors

The X / Y / Z linear axes are driven by linear motors to realize high speed and accuracy, as well as superior positioning and repeatability.

Up to 2G

Description			FM 200/5AX linear	FM 35 FM
Rapid	X / Y / Z	m/min (ipm)	50 / 50 / 50 (1968.5 / 1968.5 / 1968.5)	80 (3149.3)
		m/sec ²	14.7 / 14.7 / 14.7 [1.5G / 1.5G / 1.5G]	9.8 / [1G]

Rotary Axes Equipped with Direct Drive Motors*

The rotary table is equipped with a direct drive motor for rapid rotation coupled with rapid acceleration and deceleration. Thermal error is minimized by the water cooling system.

Description		Unit	FM 200/5AX linear	FM 350/5AX linear
Rapid	A / C	r/min	100 / 200	50 / 100
		deg	140 / 360	240 / 360
Load Capacity		kg (lb)	15 (33.1)	100 (220.5)

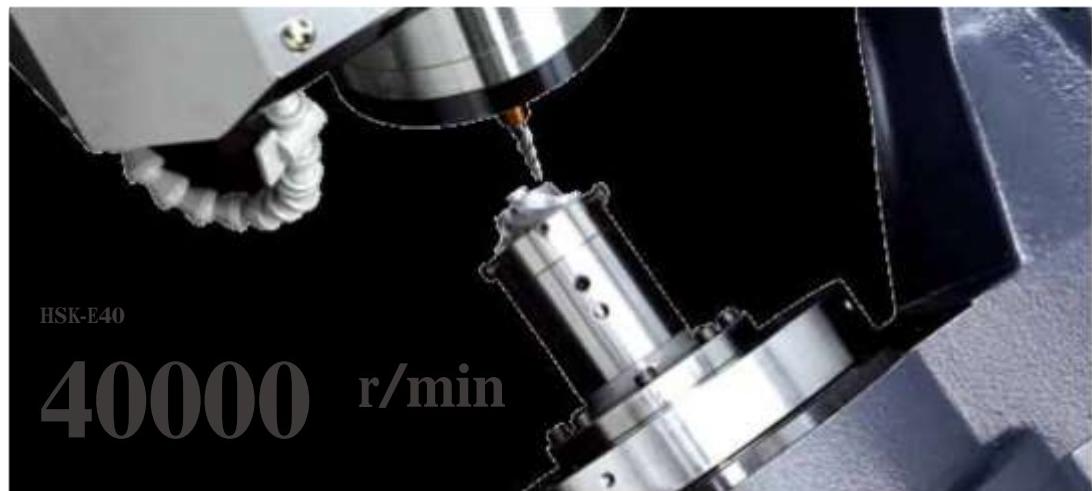


Spindle

The spindle provides incomparably high productivity and machining accuracy.

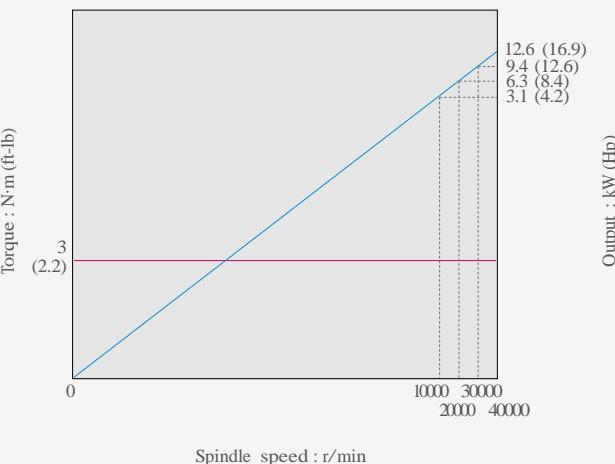
Ultra-high-speed Spindle

One of the highest-speed spindles in its class, the ultra-high-speed enhances productivity and machining accuracy.



HEIDENHAIN

Spindle Speed : 40000 r/min
Spindle Motor : 12.6 kW (16.9 Hp)



Magazine

The machine's structure has been simplified with the addition of a direct-drive motor, while the operator's convenience has been enhanced by manual magazine operation for tool storage.

Tool Magazine

* FM 200/5AX model

Description	Unit	FM 200/5AX linear	FM 350/5AX linear FM 400 linear
No.	ea	24	40
Max tool diameter	mm (inch)	50 (2.0)	
Max tool length	mm (inch)	180 (7.1)	
Tool change time	s	8	10



Standard / Optional Specifications

Diverse optional features are available for customer-specific requirements.

Basic Information

Basic Structure

Travel Axis

Detailed Information

Options

Capacity Diagram

Specifications

Customer Support Service

≈ Standard * Optional X N/A

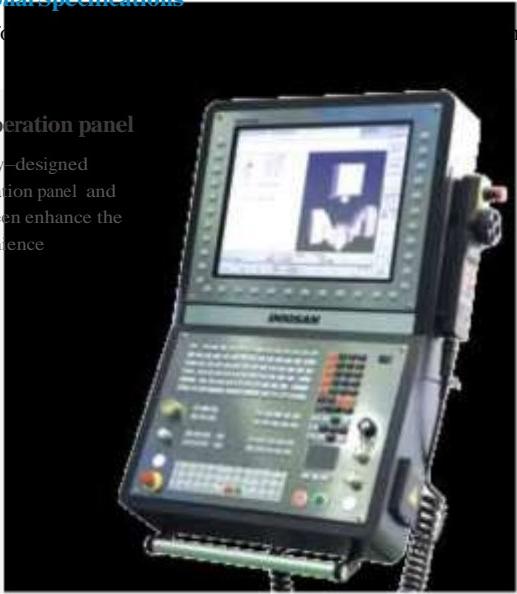
NO.	Description	Features	FM 200/5AX linear	FM 350/5AX linear	FM 400 linear
1	Tool magazine	24 tools	≈	X	X
2		40 tools	X	≈	≈
3	Tool shank type	HSK-E40	≈	≈	≈
4	Auto door lock		≈	≈	≈
5	Rotary table	Ø200	≈	X	X
6		Ø350	X	≈	X
7	Linear scale	X-axis	≈	≈	≈
8		Y-axis	≈	≈	≈
9		Z-axis	≈	≈	≈
10	Spindle	40000 r/min	≈	≈	≈
11		Spindle head cooling system	≈	≈	≈
12		Thermal error compensation system	≈	≈	≈
13	Spindle motor power	12.6 kW (HEIDENHAIN)	≈	≈	≈
14	Auto tool measuring device	NT-2_BLUM	≈	≈	≈
15	Auto work measuring device	OMP400_RENISHAW (W/Receiver)	≈	≈	≈
16		OMI-2C_RENISHAW (Receiver Only)	≈	≈	≈
17	Master tool for auto tool measurement	CALIBRATION TOOL_BLUM (HSK E40)	≈	≈	≈
18	Auto power cut-off		≈	≈	≈
19	Coolant	FLOOD (0.7kW_0.8MPa)	≈	X	X
20		FLOOD (1.5 kW_0.69MPa)	X	≈	≈
21		SHOWER	≈	≈	≈
22	Chip bucket		≈	≈	≈
23	Chip conveyor	Chip pan	≈	≈	≈
24		Hinged type	X	≈	≈
25		Drum type	≈	X	X
26	Table	500 x 600 mm	X	X	≈
27	Test bar		≈	≈	≈
28	AIR	AIR BLOWER	≈	≈	≈
29	MPG	Portable MPG	≈	≈	≈
30	MQL		≈	≈	≈
31	NC system	HEIDENHAIN iNCS530	≈	≈	≈
32	OIL SKIMMER	BELT TYPE	≈	X	X
33		TUBE TYPE	X	≈	≈

Standard / Optional Specifications

Diverse options for your specific needs.

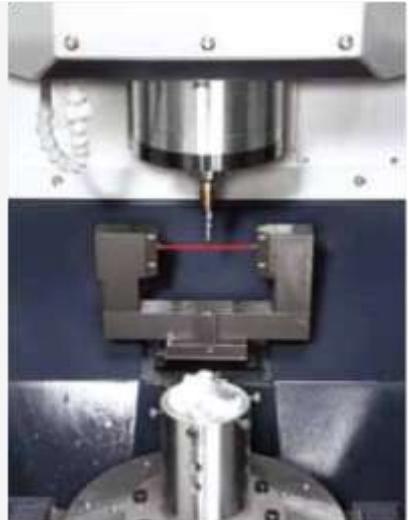
Convenient operation panel

The ergonomically-designed Heidenhain operation panel and 19-inch large screen enhance the operator's convenience.



Tool length measurement device

The standard tool length laser measuring device secures the highest degree of accuracy even at super-high- speed operation. (The touch probe is optional.)



Roller LMG

The roller-type LM Guideway has been adopted to ensure excellent rigidity and accuracy of the linear travel axes.



Linear scale (standard for all axes)

All axes are equipped with the linear scale as a standard feature to maintain the highest degree of accuracy over many hours of operation.



Gantry loader option

Information on detailed specifications required prior to ordering.



OMP 400 option

FM 200/5AX implementation



Recommendations for Machine Operation

Unlike ball-screw-type machines, a water chiller is used to cool down the linear motors and direct-drive motors. As such, the machine is sensitive to the control temperature of the chiller. Since the water chiller is controlled according to the ambient temperature, machine accuracy can be maintained and guaranteed in a constant temperature environment.

- Recommended operating conditions: Ambient temperature: 20±1.5°C, Temperature change: 0.4 °C/hr or less, ±1.5°C/24hr, Relative humidity: 20~80%

External Dimensions HEIDENHAIN iTNC530



Superior Hardware Specifications

19" LCD and capacious 144GB memory

Basic Information

Basic Structure
Travel Axis

Detailed Information

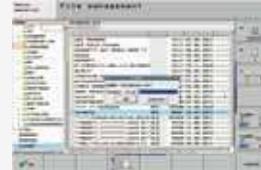
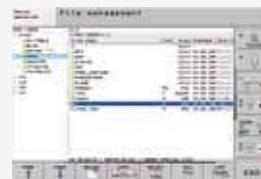
Options
Capacity Diagram
Specifications

Customer Support Service

Description	HEIDENHAIN iTNC530	Remarks
Screen size	19" LCD	-
Storage memory	144GB	-
Interference prevention system	Optional	-
Kinematic OPT.	Standard	Measuring device not included
Look-ahead block	1024 blocks	-
3D line graphics	Standard	-

Convenient Features

Data are controlled in the folder structure; convenient communication enabled by USB devices.



Various built-in pattern cycles for a wider scope of application.

Tool length, diameter and work pieces are measured using stored tool measurement graphic cycles.



Graphic simulation

Before starting the actual cutting process, graphic process simulation of the NC program can be carried out using TEST RUN. The cutting time can be estimated.



Kinematic Opt (rotary axes center correction)

The interactively (graphically) supported fixed cycle enables easy measurement of the centers of the rotary axes.



Collision Protection System option

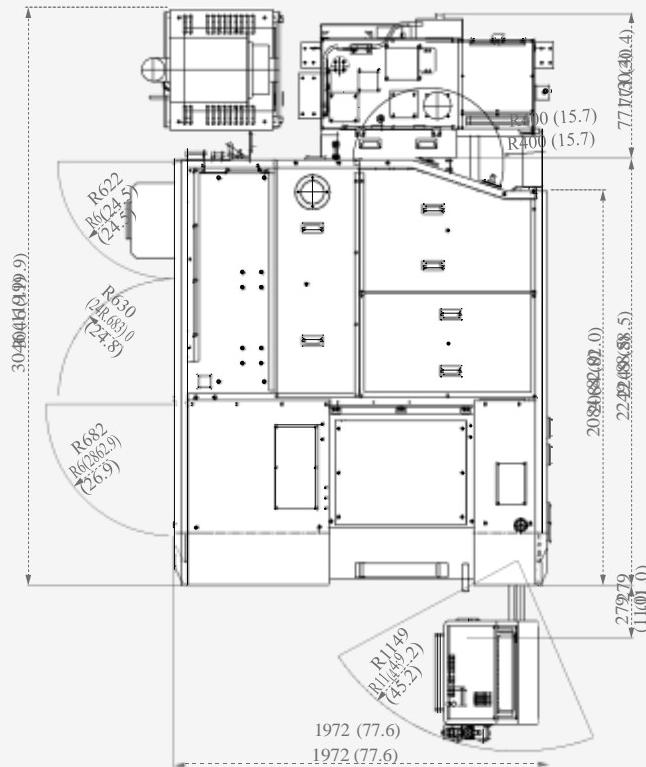
The motion of the machine can be simulated on a 3D basis to substantially prevent mechanical interference.
(Tool length is also recognized.)



FM 200/5AX linear

Unit: mm (inch)

Top View



Front View

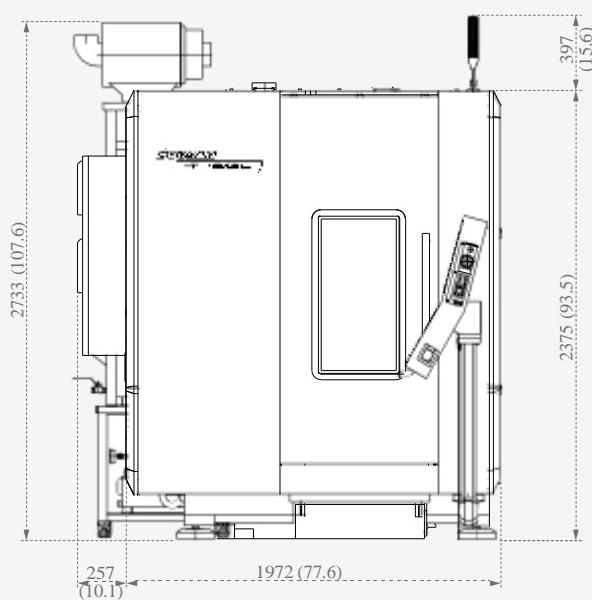


Table / Tool Shank

Basic Information

Basic Structure
Travel Axis

FM 400 linear
FM 350/5AX linear

Unit: mm (inch)

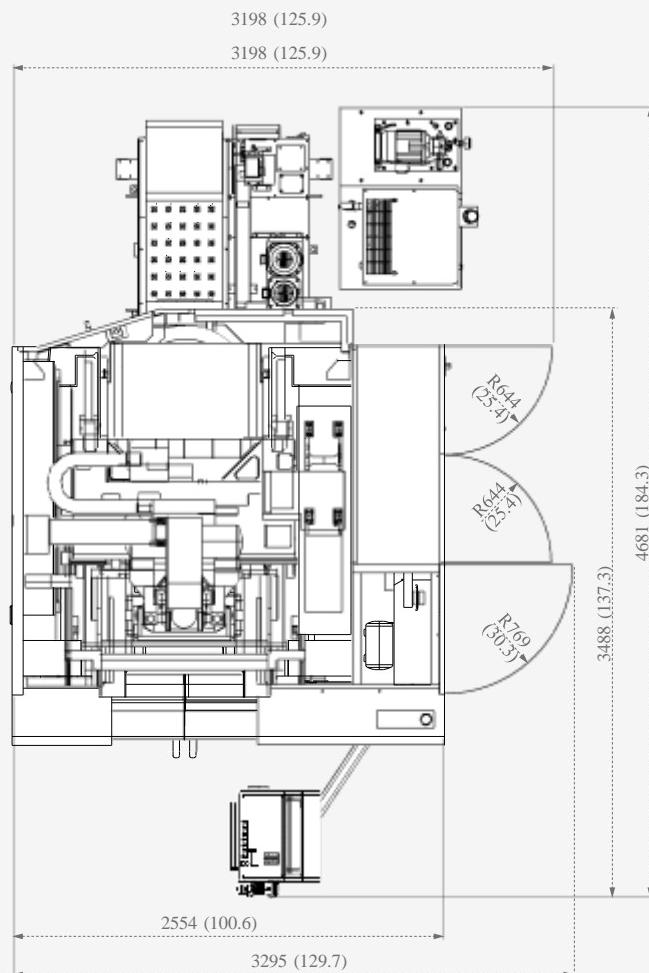
Detailed Information

Options
Capacity Diagram
Specifications

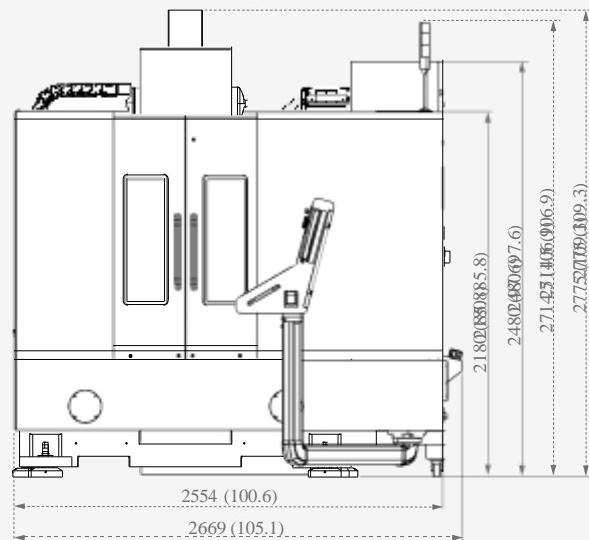
Customer Support

Service

Top View



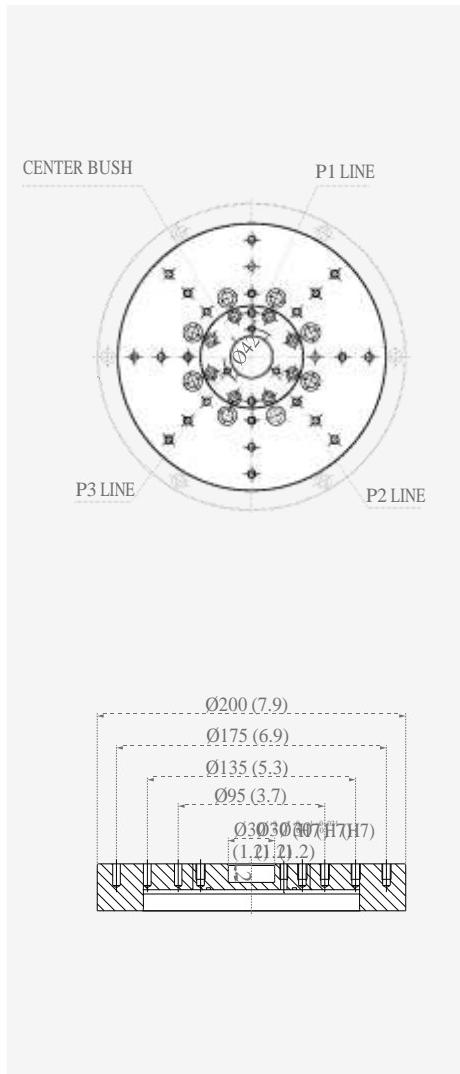
Front View



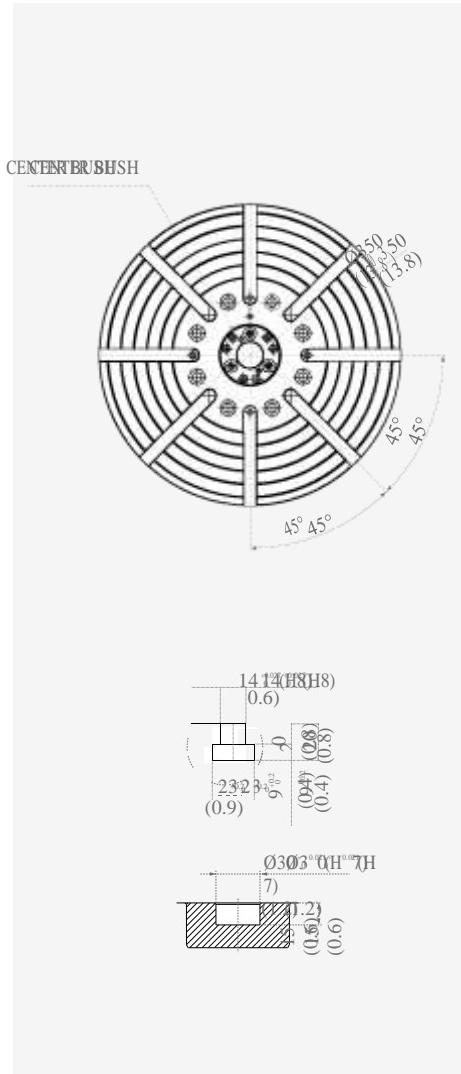
External Dimensions**Table**

Unit: mm (inch)

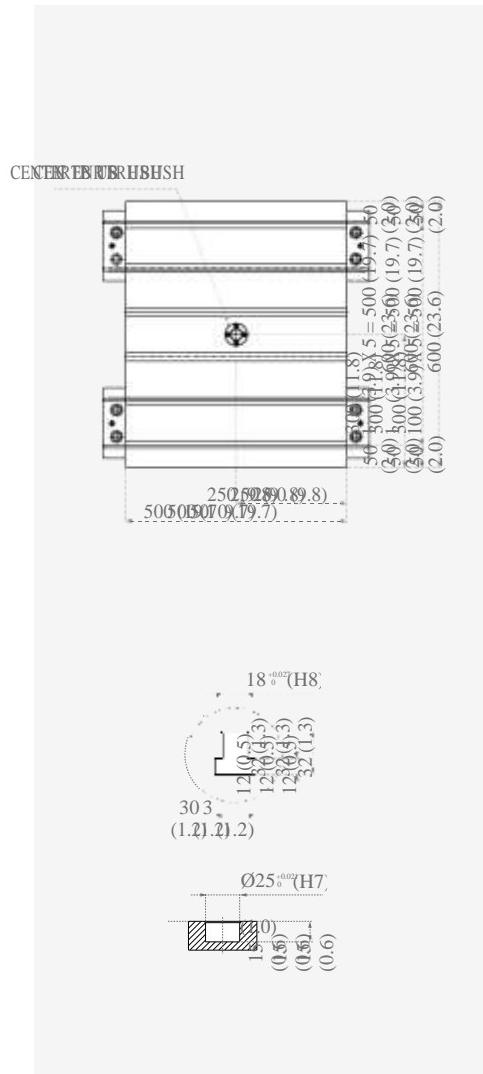
FM 200/5AX linear



FM 350/5AX linear

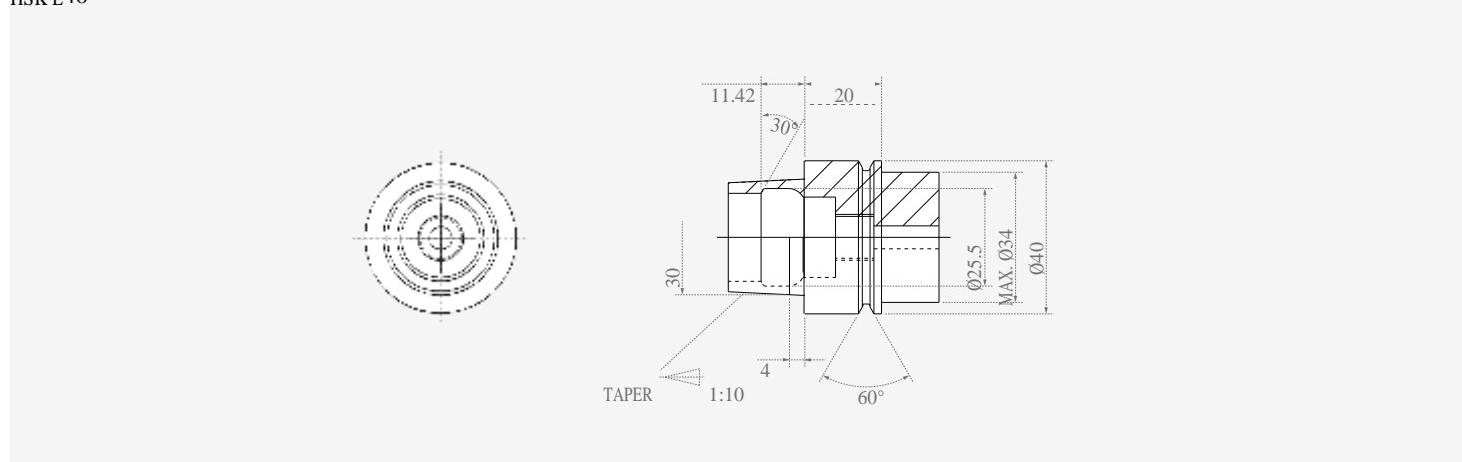


FM 400 linear

**Tool Shank**

Unit: mm (inch)

HSK E40



NC Unit Specifications

Basic Information

Basic Structure
Travel Axis

Detailed Information

Options
Capacity Diagram
Specifications



Customer Support Service

Description			Unit	FM 200/5AX linear	FM 350/5AX linear	FM 400 linear
Travel	Travel distance	X-axis	mm (inch)	200 (7.9)	400 (15.7)	
		Y-axis	mm (inch)	340 (13.4)	600 (23.6)	
		Z-axis	mm (inch)	300 (11.8)	350 (13.8)	
		A-axis	deg	140 (-10 ~ +130)	240	-
		C-axis	deg		360	-
	Distance from spindle center to table top	mm (inch)	110~410 (4.3~16.1)	50~400 (2.0~15.7)	150~500 (5.9~19.7)	
Feed rate	Rapid traverse rate	Distance from spindle center to column	mm (inch)	230 (9.1)	300 (11.8)	
		X-axis	m/min (ipm)	50 (1968.5)	80 (3149.6)	
		Y-axis	m/min (ipm)	50 (1968.5)	80 (3149.6)	
		Z-axis	m/min (ipm)	50 (1968.5)	80 (3149.6)	
		A-axis	r/min	100	50	-
	C-axis	r/min		200	100	-
Table	Cutting feed rate	m/min (ipm)	20 (787.4)	30 (1181.1)	30 (1181.1)	
	Table size	mm (inch)	ø 200 (ø 7.9)	ø 350 (ø 13.8)	500 x 600 (19.7 x 23.6)	
	Loading capacity	kg (lb)	15 (33.1)	100 (220.5)	600 (1322.8)	
Spindle	Max. spindle speed	r/min		40000		
	Spindle taper	-		HSK E40		
	Max. spindle torque	N·m (ft-lb)		3 (2.2)		
Automatic tool changer	Tool shank type	-		HSK E40		
	Tool storage capacity	ea	24		40	
	Max. tool diameter	mm (inch)		50 (2.0)		
	Max. tool length	mm (inch)		180 (2.9)		
	Max. tool weight	kg (lb)		1 (2.2)		
	Tool selection	-		FIXED		
	Tool change time (tool to tool)	s	8		10	
Motor	Tool change time (chip to chip)	s	10		13	
	Spindle motor power	kW (Hp)		12.6 (16.9)		
	Coolant pump motor power	kW (Hp)	0.7 (0.9)		1.5 (2.0)	
Power Source	Power consumption	kVA	66.4	88.3		63.5
	Compressed air pressure	MPa (psi)		0.54 (78.3)		
Tank Capacity	Coolant tank capacity	L	310		300	
	Lubricant tank capacity	L		5		
Tank Capacity	Height	mm (inch)	2375 (93.5)	2775 (109.3)		
	Length	mm (inch)	2249 (88.5)	2585 (101.8)		
	Width	mm (inch)	1972 (77.6)	2669 (105.1)		
	Weight	kg (lb)	6800 (14991.2)	12000 (26455.1)		
Controller			-	HEIDENHAIN iTNC 530		

Recommended operating conditions:

Ambient temperature: $20 \pm 1.5^\circ\text{C}$
Temperature change: $< 0.4^\circ\text{C}/\text{h} < \pm 1.5^\circ\text{C}/24\text{h}$
Relative humidity: 20~80%

Machine Specifications

**HEIDENHAIN
iTNC 530**

AXES CONTROL

- Controlled axes	X, Y, Z, C, A 5 axes
- Simultaneously controllable axes	
Positioning / Linear interpolation	5 axes
Circular interpolation	2 axes
Helical interpolation	5 axes
- Feedrate override	0 - 150 %
- Least command increment	0.0001 mm (0.0001 inch)
- Least input increment	0.0001 mm (0.0001 inch)
- Maximum commandable value	+99999.999 mm (+3937. inch)
- Pulse handle feed	Portable manual pulse generator
Machine Model	: FM400 linear / FM 350 / 5AX linear
Portable manual pulse generator	
Linear / non-linear axis error backlash	
Reversal spikes during circular movement	
Offset, thermal expansion, stickiness, sliding friction	

SPINDLE FUNCTION

- Spindle orientation	
- Spindle speed command	S5 digits
- Spindle speed override	0 - 150 %

TOOL FUNCTION

- 3-dimensional tool compensation	
- Number of tool offsets	999 ea
- Tool length compensation	
- Tool management (tool table)	
- Tool management (tool table)	Tool numbers and names
- Tool management (tool table)	Tool length L and tool radius R
- Tool management (tool table)	Tool life management & replacement tool
- Tool number command	
- Tool radius compensation	

PROGRAMMING & EDITING FUNCTION

- Background editing	
- Heidenhain conversational format programming	
- Program memory	Hard disk with 26GB for NC programs No limit on number of programs
- 3-D touch probe application	
Touch probe functions for compensating workpiece misalignment	
Touch probe functions for setting data	
Touch probe functions for automatic workpiece measurement	
- Block processing time	0.5 m [s]
- Contour elements	
Straight line, chamfer, circular arc, circle center, circle radius	
Corner rounding, tangentially connecting circle, B-spline	
- Coordinate transformation	
Coordinate shift, coordinate rotation	

Mirror image, scaling

Tilting the working plane

RS - 232C / Ethernet (100Base T)

- Data interface

- Fixed cycle (canned cycle)

Machine Model : FM400 linear

Drilling cycle

(drilling, pecking, reaming, boring, tapping, rigid tapping)

Milling, finishing rectangular, circular pockets

Linear and circular hole patterns

Linear and circular hole patterns

Milling pockets and islands

Cylindrical surface interpolation

- FK free contour programming

- Mathematical functions

+, -, x, ÷, √, sin, cos, tan, arcsin, arccos, arctan

Logical comparison (=, ≠, <, >, ≤, ≥)

- Program jumps

Subprograms, program section repeats

- Programming support

Functions for approaching / departing the contour

On-screen pocket calculator, structuring of programs

- Kinematic OPT

- Kinematic COMP

- Dynamic Collision Monitoring

GRAPHIC FUNCTIONS

- Graphic display

Interactive programming graphics

Test run graphics (3-D representation)

Program run graphics (3-D representation)

- MDI / CRT unit

19" TFT color flat panel

OPTIONAL SPECIFICATIONS

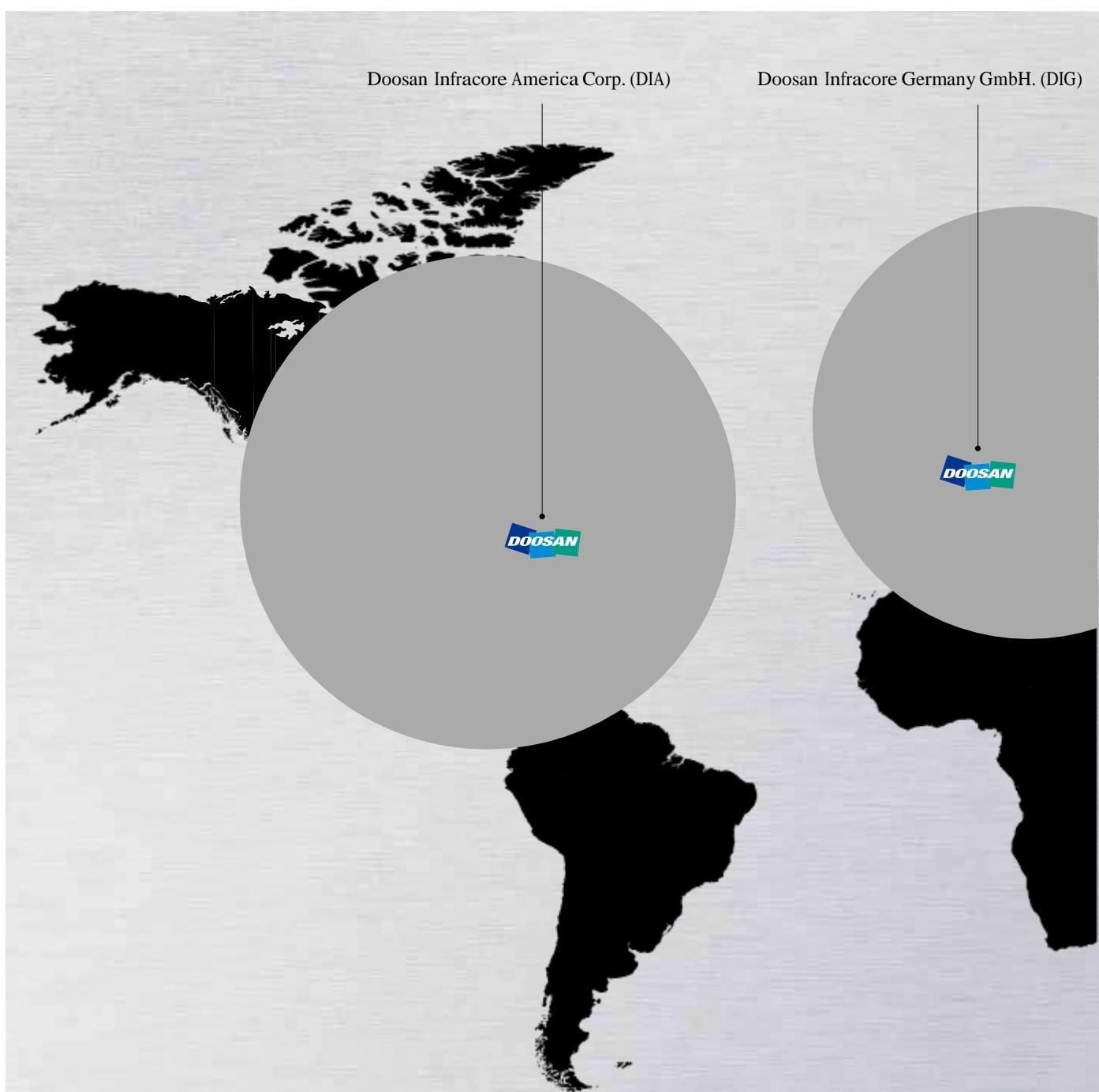
- Controlled axes

Max. 12 axes in total

- Digitizing with 3-D triggering touch probe

- Digitizing with 3-D measuring touch probe

Responding to Customers Anytime, Anywhere



Global Service Support Network

Corporations

5

Dealer Networks

128

Technical Centers

21

Factories

4

Technical Center: Sales Support, Service Support, Parts Support

Doosan Machine Tools' Global Network, Responding to Customer's Needs nearby, Anytime, Anywhere

Doosan machine tools provides a system-based professional support service before and after the machine tool sale by responding quickly and efficiently to customers' demands. By supplying spare parts, product training, field service and technical support, we can provide top class support to our customers around the world.

Doosan Infracore Yantai Factory (DIY)

Doosan Infracore Construction Equipment India Pvt. Ltd. (Machine Tool Div.) (DICEI)

DIY Shanghai Office

Doosan Infracore Seoul Office

Doosan Infracore Namsan Factory
Doosan Infracore Daewon Factory
Doosan Infracore Sungju Factory

Customer Support Service

We help customers to achieve success by providing a variety of professional services from pre-sales consultancy to post-sales support.

Supplying Parts



- Supplying a wide range of original Doosan spare parts
- Parts repair service

Field Services



- On site service
- Machine installation and testing
- Scheduled preventive maintenance
- Machine repair

Technical Support



- Supports machining methods and technology
- Responds to technical queries
- Provides technical consultancy

Training



- Programming / machine setup and operation
- Electrical and mechanical maintenance
- Applications engineering

Domestic Service Support Network

Integrated Support Centers

2

Sales Branch Offices

7

Post-Sales Service Centers

6

Designated Repair Service Centers

31

Product Specification



Description	UNIT	FM 200/5AX linear	FM 350/5AX linear	FM 400 linear
Max. spindle speed	r/min		40000	
Motor power	kW (Hp)		12.6 (16.9)	
Tool taper	taper		HSK E 40	
Travel distance (X / Y / Z)	mm (inch)	200 / 340 / 300 (7.9 / 13.4 / 11.8)		400 / 600 / 350 (15.7 / 23.6 / 13.8)
Tool storage capacity	ea	24	40	
Table size	mm (inch)	Ø 200 (Ø 7.9)	Ø 350 (Ø 13.8)	500 x 600 (19.7 x 23.6)
Table tilting / rotation angle (A / C)	deg	140 / 360	240 / 360	-
NC system	-		HEIDENHAIN	



Doosan Machine Tools

<http://www.doosanmachinetools.com>

Optimal Solutions for the Future

Head Office

Doosan Tower 20th FL., 275, Jangchungdan-Ro
(St), Jung-Gu, Seoul
Tel +82-2-3398-8693 / 8671 / 8680
Fax +82-2-3398-8699

Doosan Infracore America Corp.

19A Chapin Rd., Pine Brook, NJ 07058, U.S.A.
Tel +1-973-618-2500
Fax +1-973-618-2501

Doosan Infracore Germany GmbH

Emdener Strasse 24, D-41540 Dormagen,
Germany
Tel +49-2133-5067-100
Fax +49-2133-5067-001

Doosan Infracore Yantai Co., LTD

13 Building, 140 Tianlin Road, Xuhui District,
Shanghai, China (200233)
Tel +86-21-6440-3384 (808, 805)
Fax +86-21-6440-3389

Doosan Infracore Construction Equipment

India Pvt. Ltd. (Machine Tool Div.)
106 / 10-11-12, Amruthahalli, Byatarayanapura,
Bellary road, Bangalore-560 092, India
Tel +91-80-4266-0122 / 121 / 100



Doosan International South East Asia

Pte Ltd.
42 Benoi Road, Jurong 629903, Singapore
Tel +65-6499-0200
Fax +65-6861-3459

For more details, please contact Doosan.

The specifications and information above-mentioned may be changed without prior notice.